SPECIFICATION CHANGE NOTICE

Date Prepared: 16 August 1996

1.	2.	3. Code Ident.	4. Spec. No./Rev.
The Boeing Company Johnson Space Center Houston Tx 77058	☐ Proposed ☒ Approved	2B945	SSP 54500
		5. Code Ident. 2B945	6. SCN No. SCN 002

7. System Designation	8. Related Change No./Title	9. Contract No.	10. Directive No./SSCN NO.
ISS	ECP 336	NAS15–10000	SSCN 000336

11. Configuration Item Nomenclature	12. Effectivity
International Ground System Specification	N/A

THIS NOTICE INFORMS RECIPIENTS THAT THE DOCUMENT IDENTIFIED BY THE NUMBER (AND REVISION LETTER) SHOWN IN BLOCK 4 HAS BEEN CHANGED. THE PAGES CHANGED BY THIS SCN BEING THOSE FURNISHED HEREWITH AND CARRYING THE SAME DATE AS THIS SCN. THE PAGES OF THE PAGE NUMBERS AND DATES LISTED BELOW IN THE SUMMARY OF CHANGED PAGES COMBINED WITH NON–LISTED PAGES OF THE ORIGINAL ISSUE OF THE REVISION SHOWN IN BLOCK 4 CONSTITUTE THE CURRENT VERSION OF THIS SPECIFICATION.

13. SCN No.	14. Pages Changed (Indicate Deletions)	S*	A*	15. Date
002	Cover	x		
	Revision and History	x		
	Appendix D			
	D–i through D–iv	x		
	D–1 through D–18	x		
	D–19 through D–20		x	
	Appendix F			
	F–i through F–xvi	x		
	F–13 through 16	x		
	F–16a through F–16d		x	
	Order of SCN Incorporation 001, 002			

16. Technical Concurrence

_____ _____

Date

* "S" indicates supersedes earlier page. "A" indicates added page.

Form Date: 8/12/94

International Ground System Specification Document

International Space Station Program

APRIL 26, 1996
Incorporates SCN 002

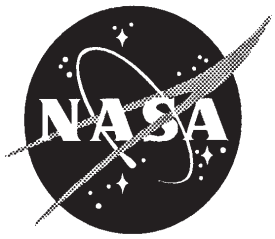
Russian Space Agency

Canadian Space Agency

Agence spatiale canadienne

agenzia spaziale italiana
(Italian Space Agency)

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas



REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE
	Initial Release	4–26–96
	SCN001 incorporates ECP 315 (07–16–96)	7–16–96
	SCN002 incorporates ECP 336 (08–16–96)	8–16–96

APPENDIX D
SEGMENT SPECIFICATION FOR THE JAPANESE EXPERIMENT MODULE GROUND SYSTEM REQUIREMENTS

TABLE OF CONTENTS

SCN 002

TABLE OF CONTENTS (continued)

TABLES

FIGURES

D1. SCOPE

This specification establishes the performance and design requirements for the Japanese Experiment Module (JEM). This specification has been developed using SSP 41171, Preparation of Program Unique Specifications (a tailored version of MIL–STD–490), as a guide for type A system segment specification. Sections 1 and 3.1 are for informational purposes only and are not binding between National Aeronautics and Space Administration (NASA) and the National Space Development Agency of Japan (NASDA). Documents listed in section 2 are applicable to NASDA only to the extent that they are referenced in section 3.

The paragraph headers in 3.2.1 are based on the functional decomposition allocations to the JEM in the Space Station System specification, SSP 41000. The requirements in section 3.2.1 define the performance of the JEM. Requirements in sections 3.2.2 through 3.6 are constraints with which the JEM must comply. The performance requirements herein are applicable during nominal operations only and do not account for maintenance or contingency events unless otherwise addressed.

D1.1 Identification.

Not applicable.

D1.2 System overview.

The JEM is a facility developed by NASDA for the purpose of supporting research and development experiments in a microgravity environment in earth orbit as a segment of the Space Station. The JEM supports internally and externally mounted user payloads, provides pressurized and unpressurized logistics support, and remote manipulation of external items.

D2. APPLICABLE DOCUMENTS

Paragraphs which reference documents identified with asterisks below are not applicable until NASDA review and concurrence.

D2.1 Government documents.

D2.1.1 Specifications, standards, and handbooks.

The following specifications, standards, and handbooks of the exact issue shown form a part of this specification to the extent specified herein. In the event of a conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

SSP 41171 Rev. A (May 19, 1995)	International Space Station Alpha Program Preparation of Program – Unique Specifications. (Reference paragraph 1.)
*SSP 45012 Rev TBD	CCC to NASDA Ground Segment ICD (Reference paragraphs D3.1.5.1.1, D3.1.5.1.1.1, D3.1.5.1.1.2, D3.2.1.1.1.2.1, D3.2.1.1.1.2.2, D3.2.1.2.2.1.2, D3.2.1.2.2.1.3) **SCN 002**
*SSP 45025 Rev TBD	HOSC to NASDA Gateway ICD (Reference paragraph D3.1.5.1.1, D3.1.5.1.1.3, D3.2.1.1.1.2.1, D3.2.1.1.1.2.2, D3.2.1.2.2.1.2, D3.2.1.2.2.1.3) **SCN 002**
NASDA–ESPC–1539	JEM Operations System Specification (Reference paragraph D3.7.1.3)
SSP 50200–08	Appendix D Operations Data File Standards (Reference paragraph D3.2.1.2.2.2.1)
SSP 50200–08	Appendix E Operations Nomenclature (Reference paragraph D3.2.1.2.2.2.1) **SCN 001**

(Unless otherwise indicated, copies of U.S. federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111–5094.)

D2.1.2 Other Government documents, drawings, and publications.

The following other government documents, drawings, and publications form a part of this document to the extent specified herein. Unless other wise specified, the exact issue shown applies to this segment specification.

None

D2.2 Non–Government publications.

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of a conflict between the documents referenced here in and the contents of this specification, the contents of this specification shall be considered a superceding requirement.

D2.3 Order of precedence.

In the event of a conflict between the text of this specification and references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

D2.4 Meet or exceed.

The following documents have been identified as meeting or exceeding the applicable SSP documents referenced herein:

None

D3. SYSTEM REQUIREMENTS

D3.1 System definition.

D3.1.1 System description.

The JEM is a facility consisting of a laboratory, logistics modules, robotic manipulator, and ground facilities for the purpose of supporting research and development experiments in a microgravity environment in an earth orbit. The JEM supports permanent human habitation as a segment of the Space Station. The JEM can support both internal and external user payloads and can transfer equipment and user payloads from the laboratory to the vacuum of space without the need of a pressure suited crew member. The JEM system diagram is shown in Figure D–1.

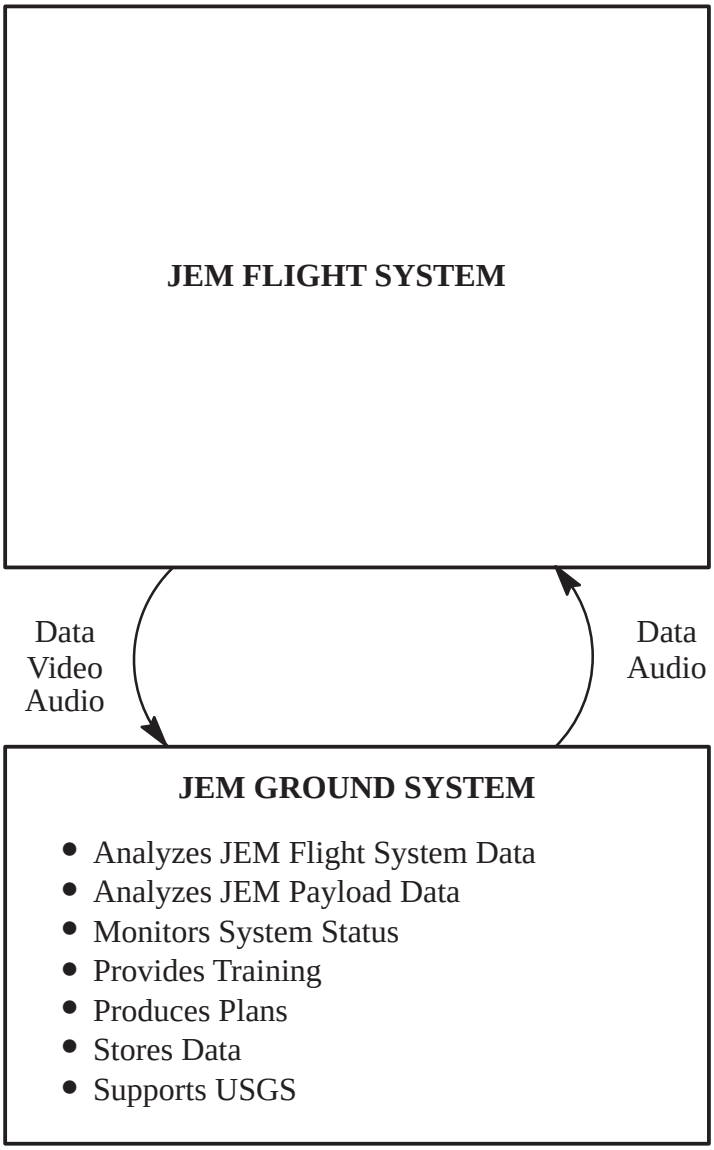


FIGURE D–1. JEM functional flow and layout

D3.1.1.1 JEM ground system.

The JEM ground system supports JEM operations, Japanese payload operations, Japanese user operations, and JEM system and Japanese payload training.

D3.1.2 Missions.

D3.1.3 Threat.

Not applicable.

D3.1.4 System diagrams.

D3.1.5 Interface requirements.

D3.1.5.1 External interfaces.

The JEM functional external interfaces are as shown in Figure D–2.

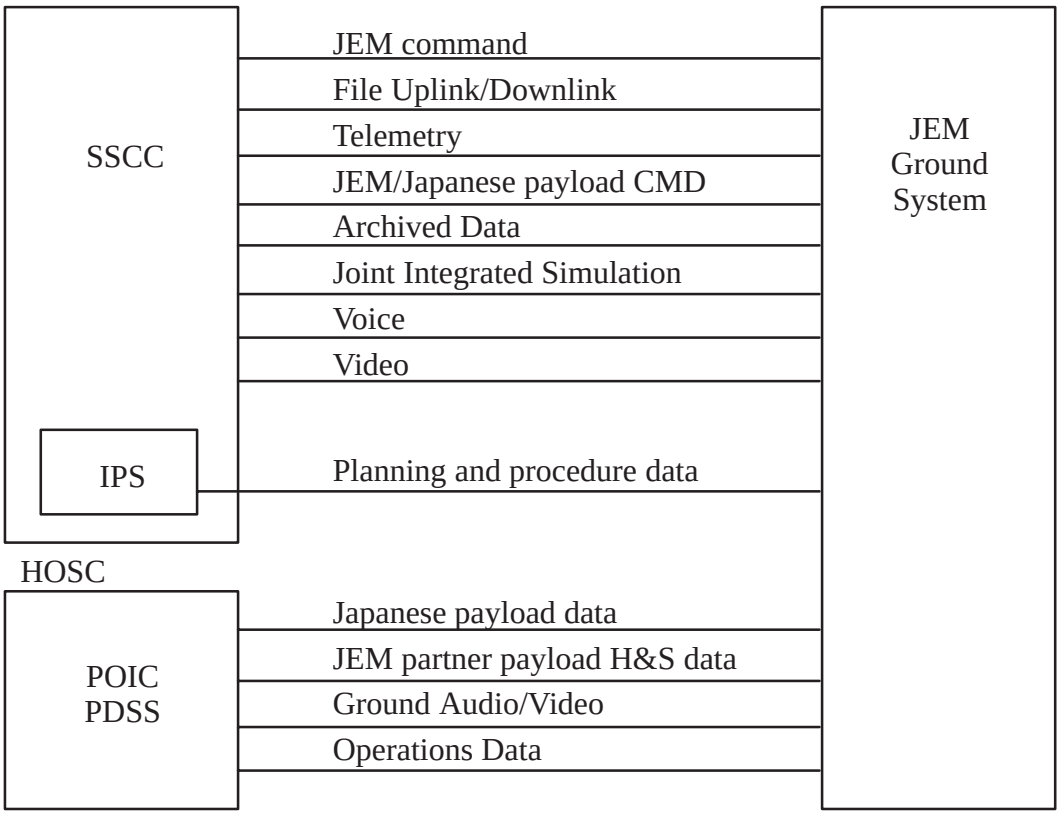


FIGURE D–2. JEM external interfaces

SCN 002

D3.1.5.1.1 United States Ground System (USGS) external interface descriptions.

This section contains the interface requirements for the USGS to JEM GS. Unless otherwise noted herein, the requirements apply to the JEM Operations Network System, Operations Control System and Operations Engineering System.

The JEM ground system will interface with USGS through jointly agreed to gateways to exchange audio and operations data, receive data and video, and send commands and files. This interface is as specified in SSP 45012 and SSP 45025. Requirements levied on the US ground system are located in USGS External Interfaces – JEM Ground System section in the USGS appendix of this document.

D3.1.5.1.1.1 SSIPC to SSCC interface description.

SSCC and SSIPC shall provide the capability to exchange voice including air–to–ground voice, planning data, and operations data, to receive ISS and JEM system data, video including air–to–ground video, to send command, flight software, and file for JEM system and payloads. This interface is shown in figure D–2 and is specified in SSP 45012.

D3.1.5.1.1.1.1 Commanding and Controlling.

D3.1.5.1.1.1.1.1 SSIPC shall provide SSIPC command data to SSCC for uplink to JEM.

D3.1.5.1.1.1.1.2 SSIPC shall receive from SSCC acknowledgment and command link configuration status for each SSIPC command received and transmitted to JEM.

D3.1.5.1.1.1.2 File Uplink/Downlink

D3.1.5.1.1.1.2.1 SSIPC originated files for uplink will include the following:

- NASDA ODF
- JEM Flight Software
- JEM Onboard Data Table
- Japanese Payload Software
- Japanese Payload Files

D3.1.5.1.1.1.2.2 SSIPC shall provide the relevant parts of JEM onboard database and JEM flight software reconfiguration changes to SSCC for uplink to JEM using the standard SSCC to C&DH uplink file capability.

SCN 002

D3.1.5.1.1.1.2.3 SSIPC shall receive activity status from SSCC of any JEM related file or data transfers to and from SSCC and ISS.

D3.1.5.1.1.1.3 Telemetry

D3.1.5.1.1.1.3.1 SSIPC shall receive unprocessed JEM system telemetry, extracted from the ISS S–band downlink, from the SSCC

D3.1.5.1.1.1.3.2 SSIPC shall select real–time, ISS processed telemetry to be received from the SSCC.

D3.1.5.1.1.1.4 Archived Data

D3.1.5.1.1.1.4.1 SSIPC shall receive access to SSCC archived files that are less than 24 hours old within 5 minutes of receipt of the request.

D3.1.5.1.1.1.4.2 SSIPC shall receive access to SSCC archived files that are greater than 24 hours and less than 1 year old within 30 minutes of the request.

D3.1.5.1.1.1.4.3 SSIPC shall receive access to archived files that are greater than 1 year old within 24 hours of the request.

D3.1.5.1.1.1.4.4 SSIPC shall receive from SSCCcommand histories of all core system commands uplinked to ISS to facilitate the maintenance of a complete record of all operations transactions with ISS.

D3.1.5.1.1.1.5 Joint Integrated Simulation

D3.1.5.1.1.1.6 Voice Requirements

D3.1.5.1.1.1.6.1 SSIPC shall receive talk/monitor capability on ISS and Space Shuttle space–to–ground voice links, from SSCC.

D3.1.5.1.1.1.6.2 SSIPC shall receive talk/monitor capability on SSCC ground voice loops.

SCN 002

D3.1.5.1.1.1.7 Video Requirements

D3.1.5.1.1.1.7.1 SSIPC shall receive from the SSCC, ISS and Shuttle Video distribution services.

D3.1.5.1.1.1.7.2 SSIPC shall receive from the SSCC selected downlink video upon request.

D3.1.5.1.1.1.7.3 SSIPC shall provide video conference capabilities for off–line coordination with SSCC.

D3.1.5.1.1.2 IPS Interface Description

The SSIPC shall provide the capability to exchange preliminary and final planning and procedures data with the IPS during both preincrement and near real–time operations. This interface is specified in SSP45012.

D3.1.5.1.1.3 HOSC Interface Description

SSIPC and POIC/PDSS shall provide the capability to exchange ground voice, planning data, operations data, and payload data for on–orbit and simulation/test support. This interface is specified in SSP 45025.

D3.1.5.1.1.3.1 Payload Data

D3.1.5.1.1.3.1.1 SSIPC shall receive Japanese payload data and JEM partner payload health and status data from the PDSS in real time.

D3.1.5.1.1.3.1.2 SSIPC shall provide the capability to request and receive stored Japanese payload data and JEM partner payload health and status from PDSS

D3.1.5.1.1.3.2 Ground Audio/Video

D3.1.5.1.1.3.2.1 POIC and SSIPC shall provide a video data communications function for video conference between the POIC and SSIPC.

D3.1.5.1.1.3.2.2 POIC and SSIPC shall provide the talk/monitor capability on POIC/PDSS ground voice loops.

D3.1.5.1.1.3.3 Operations Data

SSIPC shall provide the capability to receive/transmit operations execution data with the POIC.

SCN 002

D3.1.5.2 Internal interfaces.

The JEM functional internal interfaces are as shown in Figure D–3.

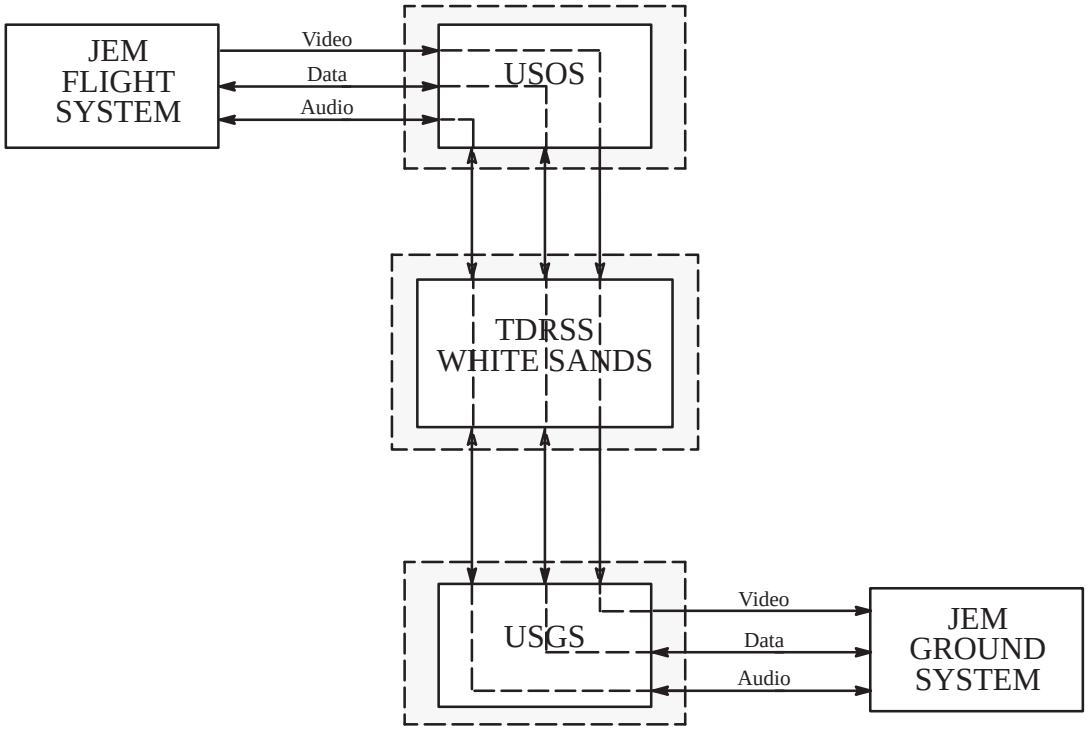


FIGURE D–3. JEM internal interfaces

D3.1.5.2.1 JEM flight system internal interface descriptions.

The flight system interfaces with the JEM ground system functionally through the USOS, Tracking and Data Relay Satellite Systems (TDRSS), and the USGS. Through this interface the JEM flight system transmits data, video, and audio to and receives data and audio from the JEM ground system.

D3.1.5.2.2 JEM ground system internal interface descriptions.

This interface is as described in paragraph 3.1.5.2.1.

D3.2 Characteristics.

D3.2.1 Performance characteristics.

D3.2.1.1 State: Perform mission – habitable.

D3.2.1.1.1 Mode: Standard habitable.

D3.2.1.1.1.1 Capability: Perform ground mission operations.

D3.2.1.1.1.1.1 Capability: Space Station system performance analysis.

The JEM ground system shall provide the capability to analyze on–orbit JEM performance.

The JEM ground system shall provide the capability to support the management of on–orbit JEM configuration, resources, maintenance, and inventory.

D3.2.1.1.1.1.2 Capability: Support on–orbit operations.

The JEM ground system shall provide the capability to monitor on–orbit JEM and Japanese payload operations, and assess operations with respect to defined plans.

The JEM ground system shall provide the capability to support the development and execution of planned and alternative on–orbit JEM operations.

The JEM ground system shall provide the capability to coordinate the JEM and user payload command and control operations.

The JEM ground system shall provide the capability to coordinate the JEM and user payload ground operations.

The JEM ground system shall have the capability to access operational and non–operational data.

D3.2.1.1.1.2 Capability: Support on–orbit ground communications.

D3.2.1.1.1.2.1 Capability: Provide data for uplink.

The JEM ground system shall provide capability to acquire, prepare, and transmit commands via USGS for uplink in accordance with ICD SSP 45012 and ICD SSP 45025.

The audio and system data shall be transmitted to the JEM via the USGS/USOS in accordance with ICD SSP 45012 and ICD SSP 45025.

SCN 001

The JEM ground system shall comply with security/privacy requirements developed by the Space Station Program Office for transmission of data for uplink.

D3.2.1.1.1.2.2 Capability: Support down link data.

The JEM ground system shall provide capability to receive and convert JEM system data and Japanese payload data from the USGS in accordance with ICD SSP 45012 and ICD SSP 45025.

The JEM ground system shall receive video, audio, high rate, and system data from the JEM via the USOS/USGS in accordance with ICD 45012 and ICD SSP 45025.

The JEM ground system shall comply with security/privacy requirements developed by the Space Station Program Office for transmission of downlink data.

D3.2.1.1.1.2.3 Capability: Provide ground–based payload physical integration.

D3.2.1.1.1.2.4 Capability: Provide ground–based interface checkout for payloads.

The JEM ground system shall provide the capability to perform interface checkout of payloads with on–orbit JEM and ground command and control capabilities.

SCN 001

D3.2.1.2 State: Support mission.

A stable condition of the Space Station which may be concurrent with and independent from the "perform mission" states. This state is characterized by the ground based preparation for and recovery from Space Station increment operations.

D3.2.1.2.1 Mode: Personnel preparation.

D3.2.1.2.1.1 Capability: Prepare and conduct training.

SCN 001

The prepare and conduct training mode consists of the functions required to ensure ground personnel and on–orbit crew working knowledge of the systems they will operate and maintain. This mode will begin when crew members start training for the activities associated with a specific increment and ends when an appropriate level of proficiency for these activities has been demonstrated. This mode consists of the capabilities as shown in Table D–I and the following unique capabilities:

TABLE D–I. Mode/capability applicability matrix

Capability	Mode															
	Standard – Habitable	Reboost – Habitable	Maneuver – Habitable	Microgravity – Habitable	Survival – Habitable	Proximity – Habitable	Assured safe crew return	External operations – Habitable	Standard – Untended	Reboost – Untended	Maneuver – Untended	Microgravity – Untended	Survival – Untended	Proximity – Untended	External operations – Untended	Personnel preparation	Operations planning
Relieve overpressure	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Equalize pressure	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Control atmosphere temperature	*	*	*	*	*	*	*	*	*	*	*	*		*	*		
Control atmosphere moisture	*	*	*	*	*	*	*	*	*	*	*	*		*	*		
Circulate atmosphere	*	*	*	*	*	*	*	*	*	*	*	*		*	*		
Illuminate internal area	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Control internal lighting	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Illuminate video area–external	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Isolate to recovery level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Recover lost function	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Isolate for safing	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Safe	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Maintain station mode	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Transition station mode	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Provide data to crew	*	*	*	*	*	*	*	*									
Accept crew inputs and commands	*	*	*	*	*	*	*	*									
Acquire function status data	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Assess function status data	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Acquire hazardous condition data	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Identify hazardous conditions	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Respond to fire	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Respond to hazardous atmosphere	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Distribute user payload power	*	*	*	*		*	*	*	*	*	*	*		*	*		
Perform user payload thermal conditioning	*	*	*	*		*	*	*	*	*	*	*		*	*		
Supply vacuum services to user payloads	*	*	*	*		*	*	*	*	*	*	*		*	*		
Distribute gases to user payloads	*	*	*	*		*	*	*	*	*	*	*		*	*		
Transfer user payload command and control data	*	*	*	*		*	*	*	*	*	*	*		*	*		
Support user payload telemetry services	*	*	*	*		*	*	*	*	*	*	*		*	*		
Support user payload video services	*	*	*	*		*	*	*	*	*	*	*		*	*		
Space station system performance analysis	*	*	*	*		*	*	*	*	*	*	*		*	*		
Support on–orbit operations	*	*	*	*		*	*	*	*	*	*	*		*	*		
Distribute power	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Collect thermal energy	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		

TABLE D–I. Mode/capability applicability matrix – Continued

Capability	Mode															
	Standard – Habitable	Reboost – Habitable	Maneuver – Habitable	Microgravity – Habitable	Survival – Habitable	Proximity – Habitable	Assured safe crew return	External operations – Habitable	Standard – Untended	Reboost – Untended	Maneuver – Untended	Microgravity – Untended	Survival – Untended	Proximity – Untended	External operations – Untended	Personnel preparation	Operations planning
Distribute thermal energy	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Distribute time	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Support internal crew restraint and mobility	*	*	*	*	*	*	*	*	*								
Control airborne particulate contaminants	*	*	*	*	*	*	*	*	*	*	*	*		*	*		
Control airborne microbial growth	*	*	*	*	*	*	*	*	*	*	*	*		*	*		
Provide direct visual access	*	*	*	*	*	*	*	*									
Provide remote visual access	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Set up voice communication	*	*	*	*	*	*	*	*									
Transmit voice communication	*	*	*	*	*	*	*	*									
Receive voice communication	*	*	*	*	*	*	*	*									
Generate pointing and support data								*									
Support uplinked data	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Provide data for downlink	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Provide data for uplink	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Support downlinked data	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Support internal equipment removal and replacement	*	*	*	*	*	*	*	*									
Support internal equipment restraint	*	*	*	*	*	*	*	*									
Limit accelerations				*								*					
Perform external robotic operations								*									
Perform task training																*	
Perform functional training																*	
Perform operations training																*	
Perform resupply / return planning																	*
Develop increment operations planning products																	*
Develop weekly planning products																	*
Perform realtime planning support																	*
Develop preliminary procedures																	*

D3.2.1.2.1.1.1 Capability: Perform basic training.

The JEM ground system shall provide JEM systems and Japanese payload task training.

D3.2.1.2.1.1.2 Capability: Perform advanced training.

The JEM ground system shall provide JEM element and Japanese payload functional training.

D3.2.1.2.1.1.3 Capability: Perform increment specific training.

The JEM ground system shall support Station increment specific operations training.

SCN 001

D3.2.1.2.2 Mode: Operations planning.

This mode consists of those functions provided by the Space Station system associated with planning, analyses, and procedures to support any specific increment. This mode begins approximately 24 months prior to an increment and ends with the completion of the increment. This mode consists of the capabilities as shown in Table D–I and the following unique capabilities:

D3.2.1.2.2.1 Capability: Perform increment planning.

D3.2.1.2.2.1.1 Capability: Perform resupply/return planning.

The JEM ground system shall provide the capability to support the development of resupply/return plans for the on–orbit JEM, Japanese payloads, and Japanese flight crew cargo items needed for increment operations.

D3.2.1.2.2.1.2 Capability: Develop increment operations planning products.

The JEM ground system shall provide the capability to develop, maintain, and transmit to the USGS the data required for preincrement planning in accordance with ICD SSP 45012 and ICD SSP 45025.

D3.2.1.2.2.1.3 Capability: Develop weekly planning products.

The JEM ground system shall support the development of the integrated JEM element Short Term Plan (STP) in accordance with ICD SSP 45012 and ICD SSP 45025.

The JEM ground system shall provide the capability to export planning data to the USGS for inclusion in the Station Short Term Plan (STP) in accordance with ICD SSP 45012 and SSP 45025.

SCN 001

D3.2.1.2.2.1.4 Capability: Perform real–time planning support.

The JEM ground system shall provide the capability to support the USGS real–time planning and replanning.

D3.2.1.2.2.2 Capability: Develop and maintain procedures.

SCN 001

D3.2.1.2.2.2.1 Capability: Develop preliminary procedures.

The JEM ground system shall provide the capability to develop JEM operations procedures.

Operations procedures and reference information shall be developed in accordance with SSP 50200–08 Appendix D Operations Data File Standards and SSP 50200–08 Appendix E Operations Nomenclature.

D3.2.1.2.2.2.2 Capability: Maintain final procedures.

The JEM ground system shall provide the capability to store JEM operations procedures.

The JEM ground system shall provide the capability to maintain JEM operations procedures.

D3.2.1.2.2.2.3 Capability: Deliver final procedures.

The JEM ground system shall provide the capability to produce final JEM operations procedures.

The JEM ground system shall provide the capability to deliver final JEM operations procedures.

D3.2.1.2.3 Mode: Reconfiguration preparation.

D3.2.1.2.3.1 Capability: Integrate reconfiguration products.

D3.2.1.2.3.1.1 Capability: Provide reconfiguration products and data files.

The JEM ground system shall support the build and management of JEM reconfiguration products and data.

D3.2.1.2.3.1.2 Capability: Verify reconfiguration products.

The JEM ground system shall verify JEM reconfiguration products.

SCN 001

D3.3 Design and construction.

D3.3.1 Workmanship.

Not applicable

D3.3.2 Interchangeability.

D3.3.3 Safety.

D3.3.3.1 Hazardous commands.

All ground and on–board crew initiated commands involving safety critical functions shall be two–step operations, with positive feedback to the initiator reporting the impending results of the command, prior to acceptance of the execute command.

D3.4 Computer resource requirements.

D3.5 Logistics.

D3.6 Personnel and training.

D3.7 Characteristics of major functional elements.

D3.7.1 JEM ground system.

D3.7.1.1 Purpose.

The purpose of the JEM ground system is to support the JEM flight system, Japanese payloads, and Japanese users both before and during on–orbit operations.

D3.7.1.2 Description.

The JEM ground system facilities are located in the Japanese Space Station Integration and Promotion Center (SSIPC) and comprises the computers, simulators, and other equipment to perform JEM engineering assessments, payload operations and user support, Japanese payload integration, logistics operations, and crew training for JEM system and Japanese payload operations.

D3.7.1.3 Capabilities.

The capabilities of the JEM ground system are described in accordance with NASDA–ESPC–1539, Operations System Specification.

D3.8 Precedence.

All specifications, standards, exhibits, drawings or other documents that are referenced in this specification are hereby incorporated as cited. All documents that are referred to by a reference document are considered to be for guidance and information only, with the exception of ICDs and Interface Requirements Documents (IRDs), which shall have their reference documents considered to be incorporated as cited. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. This document also takes precedence over the Space Station system specification. Nothing in this document, however, supercedes applicable laws and regulations unless a specific exemption has been obtained.

D4. QUALITY ASSURANCE PROVISIONS

D4.1 General.

JEM segment level qualification will be conducted by inspection, analysis, demonstration, or test. Test is chosen as the verification method to verify performance requirements that are not readily observable.

These methods are defined as follows:

a. Inspection. Engineering, inspection, hereafter referred to as inspection, is a method of verification that determines conformance to requirements by the use of standard quality control methods to ensure compliance by review of drawings and data. This method is used wherever documents or data can be visually used to verify the physical characteristics of the product instead of of the performance of the product.

b. Analysis. Analysis is a process used in lieu of, or in addition to, other methods to ensure compliance to specification requirements. The selected techniques may include, but not be limited to, engineering analysis, statistics and qualitative analysis, computer and hardware simulations, and analog modeling. Analysis may be used when it can be determined that (1) rigorous and accurate analysis is possible, (2) test is not cost effective, and (3) verification by inspection is not adequate.

c. Verification by similarity is the process of analyzing the specification criteria for hardware configuration and application for an article to determine if it is similar or identical in design, manufacturing process, and quality control to an existing article that has previously been qualified to equivalent or more stringent specification criteria. Special effort will be made to avoid duplication of previous tests from this or similar programs. If the previous application is considered to be similar, but not equal to or greater in severity, additional qualification tests shall concentrate on the areas of new or increased requirements.

d. Demonstration. Demonstration consists of a qualitative determination of the properties of a test article. This qualitative determination is made through observation, with or without special test equipment or instrumentation, which verifies characteristics such as human engineering features, services, access features, and transportability. Demonstration requirements are normally implemented within a test plan, operations plan, or test procedure.

e. Test. Test is a method in which technical means, such as the use of special equipment, instrumentation, simulation techniques, and the application of established principles and procedures, are used for the evaluation of components, subsystems, and systems to determine compliance with requirements. Test shall be selected as the primary method when analytical techniques do not produce adequate results; failure modes exist which could compromise personnel safety, adversely affect flight systems or payload operation, or result in a loss of mission objectives; or for any components directly associated with Space Station and orbiter interfaces. The analysis of data derived from tests is an integral part of the test program, and should not be confused with analysis as defined above. Tests shall be used to determine quantitative compliance to requirements and produce quantitative results.

D4.1.1 Responsibility for verifications.

NASDA is responsible for verifying the JEM fulfills the performance and constraint requirements set forth within this specification.

D4.1.2 Special tests and examinations.

Not applicable.

D4.2 Segment quality conformance inspections.

D4.2.1 Requirement/verification cross reference matrix.

Not applicable.

D5. PREPARATION FOR DELIVERY.

NA.

APPENDIX F
SEGMENT SPECIFICATION
FOR THE UNITED STATES GROUND SEGMENT

TABLE OF CONTENTS

SCN 002

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLES

FIGURES

F3.1.5 Interface requirements.

This section identifies those interfaces of the USGS, both internal and external, which will be controlled by the Program Office. More interfaces may exist than are identified in this document, but they will be controlled by the developing organizations.

F3.1.5.1 External interfaces.

The following subparagraphs identify the external interfaces of the USGS. The USGS external interface diagram is shown in Figure F–1. The diagram identifies the following types of information interfaces between the USGS and external facilities and systems:

A. Data Downlink – Data generated onboard the on–orbit Space Station and transmitted to the ground as telemetry. Data downlink may include payload health and status, science data, medical data, ancillary data, and core systems data. This interface also includes the downlink of onboard data files and command responses. Data downlink may also be identified as Simulation data downlink in support of training or Verification data downlink in support of testing.

B. Commands – Commands generated on the ground destined for the on–orbit Space Station. Command uplink includes payload commands and core system commands. This interface also includes the uplink of data files to the on–orbit Space Station. Commands may also be identified as Simulation commands in support of training or Verification commands in support of testing.

C. Air–to–Ground (A/G) Video – Video generated onboard the on–orbit Space Station and transmitted to the ground.

D. Air–to–Ground (A/G) Audio – Audio communications between the on–orbit Space Station and the ground in support of on–orbit operations including private A/G audio for medical information. A/G audio may also be identified as Simulation A/G audio in support of training.

E. Audio – Audio communications between ground facilities in support of ground functions and training.

F. Video – Video communications between ground facilities in support of ground functions. Video may include recorded video playback, video teleconferencing, or video required for training.

G. Flight Software – Software source code and data to be resident in onboard processors. Flight software is designed as core systems or payload software.

H. Planning and Procedures – Planning and procedures data required for real–time operations support or pre–increment preparations between facilities in support of ground functions.

F3.1.5.1.1 U. S. User operations facilities external interface description.

User provided facilities and equipment required to communicate with and control their respective payloads will interface with the USGS. The USGS to User Operational Facilities

interface is defined in IDD SSP 45023 (HOSC to Generic User), and SSP 50077 ICD (PDSS to Generic User), and SSP 50078 ICD (SSCC to Generic User).

F3.1.5.1.2 NASA communications system external interface description.

The NASA communications system (NASCOM) will interface with the USGS to provide all ground–ground and ground–on–orbit ISS communication. NASCOM will relay commands and data to the Tracking and Data Relay Satellite System (TDRSS) for uplink to the ISS. The NASCOM communication system will also interface with the USGS for the downlink of payload and system status data, audio, video, and payload science data. The USGS to NASCOM communications system interface is defined in ICD SSP 41154, ICD SSP 41158, ICD SSP 42104, ICD SSP 42105, and ICD SSP 42018. NASCOM also provides the ground to ground communication implementation for the appropriate internal interfaces specified in 3.1.5.2.

F3.1.5.1.3 Canadian Space Agency external interface description.

The Canadian Space Agency (CSA) ground segment will interface with the USGS to exchange audio and operations data, receive data and video, and send payload commands and files. This interface is defined in ICD SSP 45004, ICD SSP 50092 and ICD SSP 45024.

F3.1.5.1.4 European Space Agency external interface description.

The European Space Agency (ESA) ground segment will interface with the USGS to exchange audio and operations data, receive data and video, and send payload commands and files. This interface is defined in ICD SSP 45011, ICD SSP 50089 and ICD SSP 45026.

F3.1.5.1.5 NASDA JEM Ground System external interface description.

The National Space Development Agency of Japan (NASDA) ground segment will interface with the USGS through jointly agreed to gateways to exchange audio and operations data, receive data and video, and send commands and files. This interface is defined in ICD SSP 45012, ICD SSP 50091, and ICD SSP 45025.

F3.1.5.1.5.1 SSCC to SSIPC interface description.

SSCC and Space Station Integration and Promotion Center (SSIPC) shall provide the capability to exchange voice including air–to–ground voice, planning data, and operations data, to receive ISS and JEM system data, video including air–to–ground video, to send command, flight software, and file for JEM system and payloads. This interface is shown in figure F–1 and is specified in SSP 45012.

SCN 002

F3.1.5.1.5.1.1 Command and Controlling.

F3.1.5.1.5.1.1.1 SSCC shall receive command data from SSIPC and uplink it to JEM.

F3.1.5.1.5.1.1.2 SSCC shall provide to SSIPC acknowledgment and command link configuration status for each SSIPC command received and transmitted to JEM.

F3.1.5.1.5.1.2 File Uplink/Downlink.

F3.1.5.1.5.1.2.1 Downlinked files to be sent to SSIPC will consist of the following:

- JEM Downlinked Files
- Japanese Payload Downlinked Files
- Selected ISS Downlink Files

F3.1.5.1.5.1.2.2 SSCC shall receive the relevant parts of JEM on–board database and JEM flight software reconfiguration changes and shall uplink them to ISS using the standard SSCC to C&DH uplink file capability.

F3.1.5.1.5.1.2.3 SSCC shall provide activity status to SSIPC of any JEM related file or data transfers to and from SSCC and ISS.

F3.1.5.1.5.1.3 Telemetry.

F3.1.5.1.5.1.3.1 SSCC shall receive ISS S–band downlink stream, extract JEM system telemetry, and shall distribute unprocessed JEM system telemetry to SSIPC in real time.

F3.1.5.1.5.1.3.2 SSCC shall process ISS core system data stream and shall provide selected real–time ISS processed telemetry to SSIPC.

F3.1.5.1.5.1.4 Archived Data.

F3.1.5.1.5.1.4.1 SSCC shall provide access to SSIPC to archived files that are less than 24 hours old within 5 minutes of the request.

F3.1.5.1.5.1.4.2 SSCC shall provide access to SSIPC to archived files that are greater than 24 hours and less than 1 year old within 30 minutes of the request.

SCN 002

F3.1.5.1.5.1.4.3 SSCC shall provide access from SSIPC to archived files that are greater than 1 year old within 24 hours of the request.

F3.1.5.1.5.1.4.4 SSCC shall provide to SSIPC command histories of all core system commands uplinked to ISS to facilitate the maintenance of a complete record of all operations transactions with ISS.

F3.1.5.1.5.1.5 Joint Integrated Simulation.

SSCC shall provide and receive necessary simulation data to and from SSIPC for JIS.

F3.1.5.1.5.1.6 Voice Requirements.

F3.1.5.1.5.1.6.1 SSCC shall provide to SSIPC the talk/monitor capability on ISS and Space Shuttle space–to–ground voice links.

F3.1.5.1.5.1.6.2 SSCC shall provide to SSIPC the talk/monitor capability on SSCC ground voice loops.

F3.1.5.1.5.1.7 Video Requirements.

F3.1.5.1.5.1.7.1 SSCC shall provide to SSIPC the ISS and Shuttle Video distribution services.

F3.1.5.1.5.1.7.2 SSCC shall provide to SSIPC the selected downlink video upon request.

F3.1.5.1.5.1.7.3 SSCC shall provide video conference capabilities for off–line coordination with SSIPC.

F3.1.5.1.5.2 SSIPC to IPS description.

The IPS shall provide the capability to exchange preliminary and final planning and procedures data with the SSIPC during both preincrement and near real–time operations. This interface is specified in SSP45012.

F3.1.5.1.5.3 SSIPC to HOSC Interface Description.

POIC/PDSS and SSIPC shall provide the capability to exchange ground voice, planning data, operations data, and payload data for on–orbit and simulation/test support. This interface is specified in SSP 45025.

SCN 002

F3.1.5.1.5.3.1 Payload Data.

F3.1.5.1.5.3.1.1 PDSS shall provide the capability to receive the ISS Ku–Band downlink stream, extract Japanese payload data, JEM partner payload health and status data, and shall distribute it to SSIPC in real–time.

F3.1.5.1.5.3.1.2 PDSS shall provide the capability to receive SSIPC requests for stored Japanese payload data, JEM partner payload health and status, and provide to SSIPC.

F3.1.5.1.5.3.2 Ground Audio/Video.

F3.1.5.1.5.3.2.1 POIC and SSIPC shall provide a video data communications function for video conference between the POIC and SSIPC.

F3.1.5.1.5.3.2.2 POIC and SSIPC shall provide the talk/monitor capability on POIC/PDSS ground voice loops.

F3.1.5.1.5.3.3 Operations Data.

POIC shall provide the capability to receive/transmit operations execution data with the SSIPC.

SCN 002

F3.1.5.1.6 Russian Segment external interface description.

The Russian Segment (RS) ground facilities will interface with the USGS for two–way exchange of audio, operations data commands and files, payload data commands and files, and video. This interface is defined in ICD SSP 50057 and ICD SSP 50069.

F3.1.5.1.7 Space Station Processing Facility external interface description.

The USGS (the MBF) will interface with the Space Station Processing Facility (SSPF) to provide on–orbit ISS core MDM software loads in support of ground processing and testing. The SSPF will also interface with the USGS for the receipt of resupply return plans consisting of detailed resupply return manifests, logistics carrier loading plans, and launch vehicle loading plans. The SSPF interface is defined in ICD SSP 50039.

F3.1.5.1.8 Software Verification Facility external interface description.

The Software Verification Facility (SVF) will interface with the USGS to provide on–orbit ISS core MDM software loads in support of ground testing. The SVF will also interface with the USGS to provide test results and anomaly reports as produced from the final software verification process. This interface is defined in SSP 50079, MBF to SVF ICD.

F3.1.5.1.9 Shuttle Mission Training Facility external interface description.

The Shuttle Mission Training Facility (SMTF) will interface with the USGS (SSTF) to exchange simulation data and audio in support of shuttle–to–station coordination training. The USGS to SMTF interface is defined in ICD SSP 50070.

F3.1.5.1.10 Sustaining engineering facilities external interface description.

Sustaining engineering facilities will interface with the USGS to exchange data in support of systems performance analysis and to provide system flight software updates. The USGS to sustaining engineering facilities interface is defined in IPS to SSP 50080, Sust. Engrg. ICD, and SSP 50081, Sust. Engrg. to MBF ICD.

F3.1.5.1.11 International Search And Rescue external interface description.

The SSCC to international search and rescue interface provides audio communication required for coordination of search and rescue operations in support of CTV Assured Safe Crew Return according to ICD SSP 50082.

F3.1.5.1.12 Weightless Environment Training Facility external interface description.

The USGS (SSTF) to Weightless Environment Training Facility (WETF) interface provides training audio and video in support of training for ISS operations. The USGS to WETF interface is provided by ICD SSP 50071.

F3.1.5.2 Internal interfaces.

The interfaces which are within the USGS are defined in the following subparagraphs. The USGS internal interfaces are shown in Figure F–1. A description of the types of information identified in the figure is discussed in paragraph 3.1.5.1.

F3.1.5.2.1 SSCC to HOSC internal interface description.

The SSCC to HOSC (POIC) interface provides for the exchange of planning data, payload commands, command responses, data from SSCC, Space Station video to POIC, audio to/from SSCC, and audio to/from the Space Station crew. This interface is defined in ICD SSP 45001.

F3.1.5.2.2 SSCC to MBF internal interface description.

The MBF provides system flight software and system data loads to the SSCC for use within the SSCC or for uplink to the on–orbit Space Station. This interface is defined in ICD SSP 50041.

F3.1.5.2.3 SSCC to SSTF internal interface description.

The SSCC provides simulation command uplink data and audio to the SSTF and receives simulation audio, video, and data from the SSTF. This interface is defined in ICD JSC 11534 Vol II.

F3.1.5.2.4 PDSS to POIC internal interface description.

The PDSS provides payload S–band and Ku–band data to the POIC from NASCOM. This interface is defined in ICD MSFC TBD.

F3.1.5.2.5 IPS to SSTF internal interface description.

The IPS provides the SSTF with planning and procedures data to support training, procedure verification and distribution. This interface is defined in ICD SSP 50073.

F3.1.5.2.6 SSTF to NBL internal interface description.

The NBL provides video and audio to the SSTF and receives audio from the SSTF to support training. This interface is defined in ICD SSP 50084 ICD.

F3.1.5.2.7 SSTF to SSMTF internal interface description.

The SSMTF provides the SSTF with simulated audio and video to support training. This interface is defined in ICD SSP 50074.

F3.1.5.2.8 MBF to POIC internal interface description.

The MBF provides the POIC with flight command and telemetry database definitions. The POIC provides the MBF with discrepancy reports regarding flight command and telemetry database definition errors. This interface is defined in ICD SSP 50046.

This page intentionally left blank